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On the Well and Ill-Posedness of Degenerately Dispersive Equations

In some physical problems, such as granular media, sedimentation, and magma dynamics, the leading order continuum model is a degenerately dispersive equation. A rigorous analysis of equations of this type has only recently begun and remains incomplete. Though some cases are locally, and globally, well-posed, others may be ill-posed.

In this talk, we consider the Rosenau-Hyman compacton equations. Inspired by a proof of ill-posedness for a surrogate equation, we present robust numerical evidence that the $K(2,2)$ compacton equation is ill-posed for data about the zero background state. The mechanism of ill-posedness is an observed loss of continuity of the solution operator; arbitrarily small data may become arbitrarily large at a fixed time $T > 0$. We also explore the equation about a nonzero background state, and examine the limit as this reference value goes to zero.

This work is in collaboration with D.M. Ambrose, J.D. Wright and D.G. Yang (Drexel University).